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MEMORANDUM FOR PRS (In-House Publication)

FROM: PROI (STINFO) 12 Apr 2001

SUBJECT: Authorization for Release of Technical Information, Control Number: **AFRL-PR-ED-AB-2001-083** Rene Gonzalez, Steven Svejda, Shawn Phillips, Gar Hoflund, "Surface Studies of Space Survivable Hybrid Organic/Inorganic Polymers"

American Chemical Society Meeting **(Statement A)**
(Chicago, IL, 26 Aug 2001) (Deadline: 15 May 01)

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Surface Studies of Space Survivable Hybrid Organic/Inorganic Polymers

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ABSTRACT

The aggressive conditions present in low-Earth orbit (LEO) reduce the longevity of organic materials used in the construction of space vehicles, thereby restricting the number of available space-certified polymers. Many studies have been conducted in an effort to determine the degradation mechanism of polymeric materials primarily caused by surface reactions with atomic oxygen (AO), the predominant species in LEO. However, these studies were carried out after exposing these highly reactive surfaces to air prior to analysis, thus introducing artifacts not generated in the space environment. Recent testing of polymers containing the nanostructured Si-O frameworks known as POSS (polyhedral oligomeric silsesquioxanes) has shown these materials to have promising AO resistant properties. The polymers were exposed to AO produced by a hyperthermal oxygen atom source capable of producing a neutral, steady state flux of AO comparable to the actual LEO environment. In-situ XPS analysis reveals that POSS-polymers rapidly form a glassy, passivating SiO_2 layer preventing further degradation of the underlying polymer. This presentation will focus on the synthesis, AO testing and subsequent materials characterization of hybrid POSS polymers including POSS-PDMS, POSS-polyurethane, POSS-polyimide and POSS-polyolefin copolymers.

KEY WORDS: atomic oxygen, POSS, silsesquioxane, polymer, space, polyimide